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New records of dictyostelid social amoebae from China

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Abstract—Two species of dictyostelids (*Dictyostelium aureocephalum* and *Heterostelium filamentosum*) new to China were isolated from samples of forest soils; and a second Chinese record of *Coremiostelium polycephalum* (previously recorded from Taiwan) was also isolated. Descriptions and illustrations based on these isolates are provided.

Key words—*Acytosteliaceae*, *Dictyosteliaceae*, *Dictyostelida, Mycetozoa,* taxonomy

Introduction

Dictyostelid cellular slime molds (dictyostelids), with both animal-like (protozoan) and fungus-like characteristics, are the second largest group of slime molds. These organisms play a role in maintaining the balance that exists between bacteria and other organisms in soils (Raper 1984). The original system that placed dictyostelids in genera based on morphology was revised by Sheikh & al. (2018), who proposed a new classification based on unique 18S rRNA sequence signatures.

In sampling from Chinese soils, two dictyostelid species, *Dictyostelium aureocephalum* and *Heterostelium filamentosum*, were recorded as new from China, and *Coremiostelium polycephalum*, previously isolated from Taiwan, was recorded as new from Fujian Province. Descriptions and illustrations based on these newly recovered isolates are provided.

Materials & methods

Samples used for dictyostelid isolations were collected from Shandong Province, Fujian Province, and Yunnan Province, China, in 2012 and 2016. Each sample

consisted of 30–50 g of soil that was placed in a sterile whirl-pack plastic bag. Each sample bag was numbered and the sample itself preserved at 4 °C in the herbarium of the Mycological Institute of Jilin Agricultural University, Changchun, China (HMJAU). Isolation methods followed Cavender & Raper (1965), with some minor modifications outlined by Liu & al. (2019). Isolates were identified using the descriptions in Raper (1984) and the new classification system proposed by Sheikh & al. (2018). The characteristic stages in the life cycle, including cell aggregation and formation of pseudoplasmodia and sorocarps, were observed under a Zeiss Axio Zoom V16 dissecting microscope with a 1.5× objective and a 10× ocular. Slides with sorocarps were prepared with water as the mounting medium. Spores, sorophores, and sorocarps were observed on the slides and measured using a Zeiss Axio Imager A2 light microscope with 10× ocular and 10, 40, and 100× (oil) objectives. Photographs were taken with Zeiss Axiocam 506 color microscope camera. Vouchers were conserved in the Herbarium of the Mycological Institute of Jilin Agricultural University, Changchun, China (HMJAU).

Taxonomy

Dictyostelium aureocephalum H. Hagiw.,
Bull. Nat. Sci. Mus., Tokyo, B 17(3): 103. 1991. Plate 1a–g

When cultured at 23 °C on non-nutrient agar with *Escherichia coli*, sorocarps gregarious, solitary, prostrate, phototropic, normally 0.7–2.6 mm. Sorophores colorless, sinuose, with hook-like structures if prostrate, tapering from conical bases to clavate tips, basal disks small. Sori yellow, globose, commonly 70–210 μm in diam. Spores hyaline, elliptical, 5.7–8.0 × 2.9–3.9 μm, without polar granules. Aggregations with radiate streams.

Specimen examined: **China**, **Yunnan Province**, **Lijiang**, Yulong Mountains, from soil (S5204) collected 22 Oct. 2016 in a mixed forest, isolated 2016, P. Liu & al. (HMJAU MR228).

Comments—*Dictyostelium aureocephalum* was first isolated from a sample collected from the humus layer of a scrub and meadow in the alpine region of Nepal (Hagiwara 1991). This species is characterized by its yellow sori. It has PG– spores and somewhat smaller sorocarps, features that distinguish it from other dictyostelids with yellowish sori.

Heterostelium filamentosum (F. Traub & al.) S. Baldauf, S. Sheikh & Thulin,
Protist 169(1): 11. 2018. Plate 1h–l

When cultured at 23 °C on non-nutrient agar with *E. coli*, sorocarps white, erect to semi-erect, with whorls of both primary and secondary branches, the terminal segments always elongate. Sorophores colorless, tapering from bases to tips. Terminal sori always small, white, globose, commonly 30–80 μm diam.

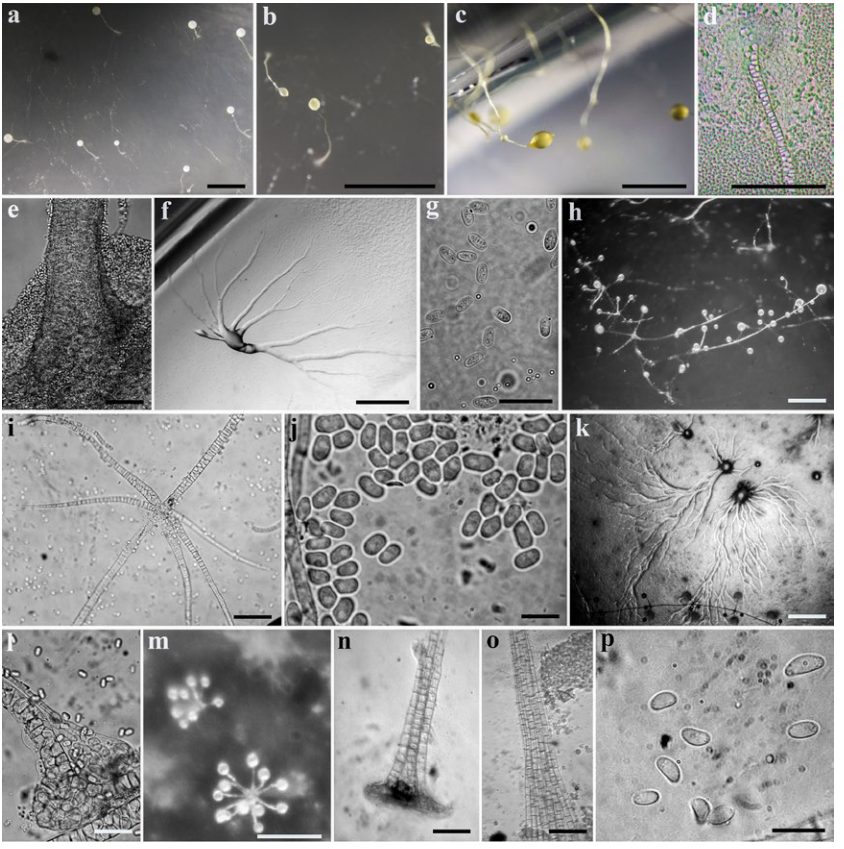

Plate 1. ***Dictyostelium aureocephalum:*** a–c. Sorocarps; d. Sorophore tip; e. Sorophore base; f. Aggregation; g. Spores. ***Heterostelium filamentosum:*** h. Sorocarps; i. Sorophore branches; j. Spores; k. Aggregation; l. Sorophore base. ***Coremiostelium polycephalum:*** m. Sorocarps; n. Sorophore base; o. Sorophore; p. Spores. Scale bars: a, b = 2 mm; c, f, h, k, m = 1 mm; d = 100 μm; e = 50 μm; g, i, n, o = 20 μm; j, l, p = 10 μm.

Lateral sori white, globose, commonly 45–160 μm diam. Spores elliptical to oval, mostly 7.5–11 × 3.5–5 μm, with unconsolidated polar granules. Aggregations radiate.

Specimen examined: **CHINA**, **Shandong Province**, **Jinan**, Jinxiang Mountain, from soil (S2832) collected 9 Aug. 2012 in a broadleaf forest, isolated 2013, P. Liu & al. (HMJAU MR182).

Comments—*Heterostelium filamentosum* was originally isolated and reported as widespread in Switzerland (Traub & al. 1981). It has also been found in

other countries such as the United States, Japan (Raper 1984; Hagiwara 1989, 2008), and China (this study). This species is characterized by its large spores, secondary branches, and elongation of branches.

Coremiostelium polycephalum (Raper) S. Baldauf, S. Sheikh, Thulin & Spiegel, Protist 169(1): 24. 2018. PLATE 1m–p

When cultured at 23 °C on non-nutrient agar with *E. coli*, sorocarps white, erect, solitary, commonly less than 1 mm tall, typically clustered to form coremiform sorocarps, normally consisting 2–10 branches per cluster. Sorophores tapering from bases to tips. Sori white or hyaline, globose, 45–85 μm diam. Spores elliptical, usually 6.0–7.5 × 3.0–3.5 μm, with unconsolidated granules. Aggregations radiate.

SPECIMEN EXAMINED: **CHINA**, **FUJIAN PROVINCE**, **Fuzhou,** from soil (S2052) collected 24 Mar. 2012 in a coniferous forest, isolated 2012, P. Liu & al. (HMJAU MR177).

COMMENTS—The type of *Coremiostelium polycephalum* was isolated from the soil of a mixed forest in South Carolina in the United States (Raper 1984; Hagiwara 1989). It is a worldwide species which has been found in Africa, America, Asia, and Europe. However, this is only the second report from China. Both of these two localities (Fujian Province and Taiwan) are located in subtropical China, so this species seems to prefer warmer habitats. This species has small clustered sorocarps developed in a coremium-like manner, a feature which allows it to be distinguished from other dictyostelids.

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